

On an undescribed light-giving Coleopterous Larva (provisionally named *Astraptor illuminator*). By ANDREW MURRAY, Esq., F.L.S.

(Plate I.).

[Read Feb. 6, 1868.]

THE purpose of this communication is to make known to the Society a new light-giving coleopterous larva. Whether the hitherto unknown larva of a light-giving species whose imago is known, or a new type altogether, may be doubtful; but at any rate, I believe, it is something entirely unknown to entomologists, and therefore a step in our knowledge which cannot fail to be interesting.

I am enabled to do so by my friend Mr. Alexander Fry, the well-known entomologist, who, if he too seldom contributes with his own pen to the literature of his favourite science, at least makes some amends by at all times most liberally communicating his stores of information to others, and by allowing and encouraging them to make use of them in his stead.

Mr. Fry passed eleven years of his life in Brazil, during the whole of which period he diligently collected and observed in almost every branch of natural history, and brought back with him probably the finest collection of Brazilian Coleoptera that anywhere exists. Nor is the multitude of observed facts which he has stored up in his note-books and his memory a whit less remarkable than the contents of his cabinets. Every entomologist who is working, or of late years has worked at any group in which South-American species occur, must confess his obligations to Mr. Fry; and so far as I myself am concerned, I gladly proclaim that the interesting communication which I now make is only a very small item of the scientific obligations under which I lie to that gentleman.

A light-giving insect of a new type is not an every-day discovery. Light-giving insects at all are one of the wonders of nature. As yet we only know four or five types of them—one in the Myriapods (the Scolopendræ), another in the Homoptera (the Fulgoridæ or Candleflies), whose light-giving properties still require confirmation, and two in the Coleoptera (the Fireflies and Glowworms). It is possible, indeed, that there may be three types in the Coleoptera, because Afzelius relates that the Paussus which he described under the name of *Paussus sphaerocerus*, was a light-giver. It dropped from the ceiling of his room at Sierra Leone on

his paper at dusk ; and he observed that its globular antennæ were phosphorescent, and that it bore them before it like lamps to light it on its way. Those who are fond of tracing the adaptation of structure to condition of life, have thought that this was an instance to the point ; for the other Paussi are inhabitants of Ants' nests ; and if we might judge of their feelings by our own, it would no doubt be very convenient to have such a pair of carriage-lamps permanently borne in front, without, what now forms the burden of our cabmen's complaint, expense for oil, risk of breakage, or trouble of cleaning. But in addition to our ignorance of the true wants and feelings of these little creatures, it so happens that the species which Afzelius saw and figured has never since been met with ; and the phosphorescence of the antennæ, either of it nor of any other Paussus, has yet been confirmed. If we deduct it, we only know the Fireflies and Glowworms as light-givers among Beetles. Of both of these, many species have been described, and doubtless many more remain to be discovered ; and I should never have dreamed of treating the occurrence of merely a new species of a known type as a matter of any special interest. But it is different with a new type, or the unknown larval form of a known type.

The difficulty which I have in dealing with it is that it is very doubtful that we really do know the larva of the Firefly. The larvæ of the Glowworms we know perfectly. They live in the open air, and their light betrays them. Plate I. fig. 9 is a representation of the larva of one of them (*Photuris versicolor*), which I have selected as being perhaps a fairer representation of the Glowworm of Brazil than our *Lampyrus* would have been ; and it will at once be seen that the larva I have now to describe (see Plate I. figs. 1 & 2) is not one of that Glowworm ; nor is it of any one I know. The larvæ of the Fireflies, on the other hand, we may presume do not live in the open air. Like the rest of the Elateridæ (to which family they belong), they live in the heart of rotten timber, or otherwise bury themselves in vegetable tissues. Living specimens of the perfect insect have been found in rotten wood, and sent home in it to this country, which they have reached alive. One would think, from analogy with the Glowworm, that, if the larva of the Firefly had been observed, it would readily have been recognized from being phosphorescent ; for not only is the female of the Glowworm luminous, but also the male ; and the larvæ, and even the eggs, are said to be faintly phos-

phorescent. But supposing the larva of the Firefly to be phosphorescent and to live in the trunks of rotten trees, it may very well be that they have been often seen in the day-time, and their phosphorescence not observed. Entomologists may go into the woods at night with nets and lamps to catch nocturnal moths; but we doubt if any one ever went to break up rotten trees. That could be as well done and the captures as well made in the day-time, and would consequently only be done with a purpose, and that the purpose of settling this very question, an idea which, so far as I know, has not yet occurred to any one possessed of the requisite facilities—that is, living in the American tropical countries.

One important means which probably exists of determining its larva has thus never been put to use; for I can find no mention anywhere of a phosphorescent larva belonging to, or resembling those of, the Elateridæ, or any other than the Glowworm. There has, indeed, been described a supposed larva of the Firefly. Erichson (Wiegmann's Arch. 1841, p. 86) describes in a few words a larva which he thinks may be referred *with doubt* to the *Pyrophorus noctilucus*, but he says nothing of phosphorescence; indeed his specimen would be dead, and either pinned or preserved in spirits, and consequently could not show it. Moreover the description, according to Candèze and Chapuis, comes nearest to the larva of *Alaus oculatus* (see Plate I. fig. 8, which is copied from their figure of that species); and this, as will be seen from the figures, is widely separated from the present larva. So far as our materials go, therefore, the inference to be drawn from them is opposed to this species belonging either to the Fireflies or the Glowworms. I am bound to say, however, that I do not think Erichson's reference can be taken as of much weight. It was obviously a mere guess as to the relationship of an unknown larva; and if we put it aside, we shall immediately see that, while there are some points in the present larva which may be used as arguments in favour of its being perhaps the larva of the Firefly, there are others which seem more opposed to it.

I shall now give an account and description of the larva in question. It has been seen by at least three gentlemen, whose accounts all correspond.

It was first seen by Mr. Fry himself, on returning to Rio one evening when night had fallen. He was accompanied by a friend, and both were on horseback. His eye was caught by a brilliant

luminous beam, obviously an insect creeping across the road before them. He dismounted and picked it up. On taking it into his hand he found that its head gave out a bright red-coloured light like the red danger-lamp of a railway carriage. It was persistent and especially visible on the top and back of the head; and down the side of the body there was a succession of exceedingly bright white lights, which were not visible all at once, or at all events were not always visible all at once. These lights streamed from the spiracles, and as the insect moved ran in succession, one after the other, from the head to the tail, down the sides like the movement of the ribs of a Serpent or the segments of a Worm, or what it really is, the segments of a Caterpillar; there was another larger light in the tail, which was also white and not persistent. Mr. Fry took it home with him to try to rear it; but it died in a day or two, and the specimen figured is its mortal remains. His memorandum made at the time is in these words:—

“No. 368.—Rio.—Red light in the head, white light in the tail, and one light on each side at each segment of the body. Light in the head permanent, the others showing by flashes.”

Mr. Fry remembers once again seeing a specimen at St. Theresa, close to Rio, but he does not recollect what became of it.

Mr. Frank Miers saw either the present specimen when it was alive, or some other; and his account of it wholly corresponds with Mr. Fry's. His expression for the colour of the head is that it was “garnet-coloured.”

Mr. John Miers, Jun., met with another specimen independently of Mr. Fry, and, he thinks, sent it home to his father, Mr. John Miers, the celebrated botanist, who, however, does not remember anything of it; nor, so far as a cursory examination of his entomological collection goes, does it appear to be in it. It is not surprising, however, that one who had seen the insect in life and been the sender, should have a more vivid recollection regarding the *envoi*, than the receiver, who could at the utmost have seen no more than such an insignificant brown morsel as that exhibited. Both Mr. John Miers, Jun., and Mr. Frank Miers speak of the specimens they saw being larger than this preserved one; about an inch in length is their estimate, while the latter is little more than half an inch.

It is probably to an allied species that Lieut. Oliver, R.A., refers in a paper “On two routes through Nicaragua,” which he

read at the Meeting of the British Association, at Dundee, in 1867. He says :—"At night the Fire- and Lanternflies were magnificent. They exhibit, when at rest, only two pale-green lights on each side of their head ; when excited or in motion, the abdominal light shines bright, of a more reddish hue, and the quicker they fly the brighter the light. A lovely Glowworm, too, we saw, with similar lights, but smaller ; on being touched, a series of minute sparks like pearls scintillated down its entire length in two rows" (p. 21).

The above accounts seem to show that the larva was full of luminous matter, that the luminous matter was white, and that it appeared red on the head from shining through the chitinous texture, whereas its natural white light was seen when the animal in its breathing or motion opened the port-holes of its spiracles. That the light was not seen through the rest of the surface of the body as through the head, would of course be due to the greater thickness of the chitinous and muscular covering.

Now this general occupation of the body by the luminous matter is the one point on which there is some coincidence with the Fire-fly. The light in the Glowworm is limited to the terminal segments of the abdomen ; in the Firefly, on the contrary, the light occupies, besides the spots on the thorax, where they are most observed, the whole interior of at least the middle of the body ; and wherever there is a chink or joint the light streams through. This is a fact noticed by every one who has observed them in their native country. On bending the body and raising the elytra, a much more intense light is seen to exist in the interior than in the two spots on each side of the surface of the thorax. This is sometimes observed even while the insects are flying about, if the position of the spectator is such that the underside of the body is exposed to him. Then he sees a light much more brilliant than usual, appearing and disappearing with the motion and change of position of the insect.

I may here observe that the diffusion of the light throughout the whole body, as in this new larva, is a phenomenon more easy of comprehension than is its limitation to the terminal segments of the abdomen as in the Glowworm, or to the nasal projection as in the Fulgora (always supposing the reported luminosity of that organ in them to be really true). It appears to me that the phenomenon in all these insects is one of chemical action, and that the chemical action is that of oxidization produced by respira-

tion—in other words, combustion. This is supported by the fact that, if we place a Glowworm in oxygen, the light becomes greatly more brilliant, the process of oxidization by respiration being assisted by the greater amount of oxygen surrounding the animal. It is the same operation as the combustion of the carbon in our own bodies when exposed to the action of oxygen in the lungs; only in the insect the lungs, instead of being confined to the thorax, are replaced by a series of tracheæ which ramify through the body. In our own bodies and in those of most other animals the combustion in question is carried on too feebly and in too diluted a state to produce light; but it is easy to conceive that a more active operation of oxidization might be sufficiently energetic to produce phosphorescence without actual flame; and I am very much disposed to believe that the stories of odyllic light averred to have been seen by highly sensitive mesmerisers streaming from the bodies of others, are only instances of such exceptionally active oxidization, going on perhaps in a state of the atmosphere unusually charged with oxygen, and seen by persons possessed of unusual acuteness of vision or nervous sensibility. But although this theory may to a certain extent explain the phenomenon of luminousness in those animals or plants where it is observable in every part subjected to the influence of oxidization, it is more difficult of application in those cases where the light is confined to some special part or organ, as in the Glowworm. In it the light is confined to a special organ, which is supplied with special nerves which control the display of light at the will of the animal. Still I hold that that light when put in action is the result of slow combustion.

There is obviously much room for interesting experiment and observation regarding the luminosity of insects. I have alluded to the greater splendour of the light when the Glowworm is placed in oxygen. Might not the combustive action be so increased by continued replenishment and saturation or condensation of oxygen as actually to ignite the animal by its own respiration? Might not luminosity be detected under similar circumstances in other insects which are not usually luminous, or in some parts of them?

It is possible, too, that there may be more than one means by which the phenomenon of luminosity is produced. We too often mislead ourselves by referring similar effects to one cause.

But, to return to the affinities of the larva in question, the general diffusion of light throughout the body indicates a greater resemblance to the Firefly than the Glowworm.

The new larva, however, differs materially from the normal type of Elateridous larvæ: *they* are all nearly rounded, cylindrical, hard worms, like a bit of wire (the Wireworm is one of them)—whereas the present species is only convex on the upperside, which has something of the consistency of the Elateridous larvæ; but the underside must have been softer, although still of a pergaminous texture; for it is wrinkled and flatter, or even somewhat concave, instead of being linear, and the segments not fitting into each other so as to make an even wire-like surface, but telescopically fitted, the anterior one always being a good deal wider than the one next behind it. The terminal segment in the great majority of cases (not in the Wireworm, which is one of the exceptions), and very often every segment, has a roughened, finely papillose part, which serves as a rasp or file-like surface by which to keep a hold on the walls of its burrow by pressing against them when it desires to move, the minute legs at the anterior end being obviously insufficient to have much effect on the long body, which extends far behind. This larva has nothing of that sort; and the reader will see by comparing the figures (2 and 8) already given that here again the resemblance is very distant.

On passing in review the whole of the larvæ of different families of Coleoptera as yet described or figured, however, I can find none which quite suits the present form; but I think it comes nearer the Elateridæ than any other. The form of the head and mouth is nearer that of it, as may be seen in figs. 3, 4 and 5. There are some of the Heteromera which also come near it, and, curiously enough, in a group of them which approaches the Elateridæ in form and appearance, as *Serropalpus*, *Dircea*, &c. Size goes for little, as, unlike the perfect Beetles, the larvæ grow; and, besides, there are species of Firefly small enough almost to suit this larva. Another reason which inclines me more than anything else to suspect that a species of Firefly may be the imago of the present larva, is the fact that we know no other luminous Beetle in Brazil except them and the Glowworms; and as the light is found to exist both in the larva and imago in the only instances where we know both, it seems an inference which we are bound to admit as probable at least, that it will

be so in all. There should therefore be in Brazil a Beetle the larva of which emits light from every exposed point; and although a common light-giving larva which lives in the heart of rotten trees may easily have escaped detection, it is extremely unlikely that a light-giving perfect insect, new in type, could possibly have done so. There would thus be no other to refer it to except the Fireflies. The extreme rarity of the larva, it having only been seen twice by Mr. Fry, is also in favour of its habitat not being known; and the fact of its having been seen at all, and, above all, creeping across the road, may have arisen from the rotten branch in which it lived having been broken off, and it dislodged from its natural position, and pounced upon by Mr. Fry before it had succeeded in procuring a new nidus for itself. This, however, is mere conjecture and speculation; the fact remains that, although apparently allied to the Elateridæ, it differs from their larvæ in several very material respects, and that in point of fact it was found, not in wood, but creeping along the ground. Future observation must determine its true relations; and the first step to doing so is for those entomologists who may have the opportunity, to ascertain what the larva of the Firefly really is. It must exist in myriads; and doubtless, if any one would bring home (to their own house in tropical America we mean), as our skilful collectors in Europe do, some stumps of wood full of larvæ, and put them in a drawer and examine them at night, the question whether this was the larva of a Firefly, or not, would be soon solved.

The technical description of the larva is as follows:—

Head corneous, short, not so broad as the thorax, in great measure hidden under the prothoracic segment, truncate in front, nearly flat above, with one ocellus, rather large, distinct, and somewhat prominent on each side of the head. *Antennæ* very short and minute, inserted on the outer side of the mandibles in front of the ocellus, composed of three articles, the first largest, and the other two successively smaller. *Mandibles* short and small, moderately stout, pointed. *Maxillæ* and other parts of the mouth not dissected out*. *Mentum* nearly truncate, slightly emarginate. *Thorax* in three pieces; the first as long as the other two, with the sides folded over below, and with two ridges sloping

* The specimen being unique and not my own property, I have not felt justified in risking the destruction of any part of it by dissecting it. The description is therefore merely what can be gathered from inspection under the lens.

inwards like an isosceles triangle, with the apex pointing backwards, and reaching back to the fore legs, and nearly to the posterior termination of that segment. *Abdomen* flattish, with ten segments, all arranged telescopically, each fitting into that before it, slightly convex above, concave below, perhaps from shrinkage; marginal separation between the upper- and underside distinct; anal segment small and open at the apex. A depressed line runs down the middle of the back of the whole larva; and there are hairs along the sides. *Stigmata* apparently angular in shape, and eight pairs in number: there are none on the last two segments; and the appearance of those in the first two segments is not so distinct as in the six that follow. *Legs* not very short, terminating in a single pointed article.

The colour is pale fawn, except the head, which is brownish.

For convenience of reference and provisionally, until the perfect form of this insect be known, I have named it *Astraptor illuminator*, from ἀστραπῆ, a flash of lightning.

EXPLANATION OF PLATE I.

- Fig. 1. Larva of *Astraptor illuminator*, natural size.
 Fig. 2. Ditto, magnified.
 Fig. 3. Underside of head of No. 1 (magnified).
 Fig. 4. Ditto (more highly magnified).
 Fig. 5. Upperside of head magnified.
 Fig. 6. Hind leg, magnified.
 Fig. 7. Side of part of abdomen, magnified.
 Fig. 8. Larva of *Alaus oculatus*, natural size.
 Fig. 9. Larva of *Photuris versicolor*, natural size.

Catalogue of the Homopterous Insects collected in the Indian Archipelago by Mr. A. R. WALLACE, with descriptions of new species. By FRANCIS WALKER, Esq., F.L.S.

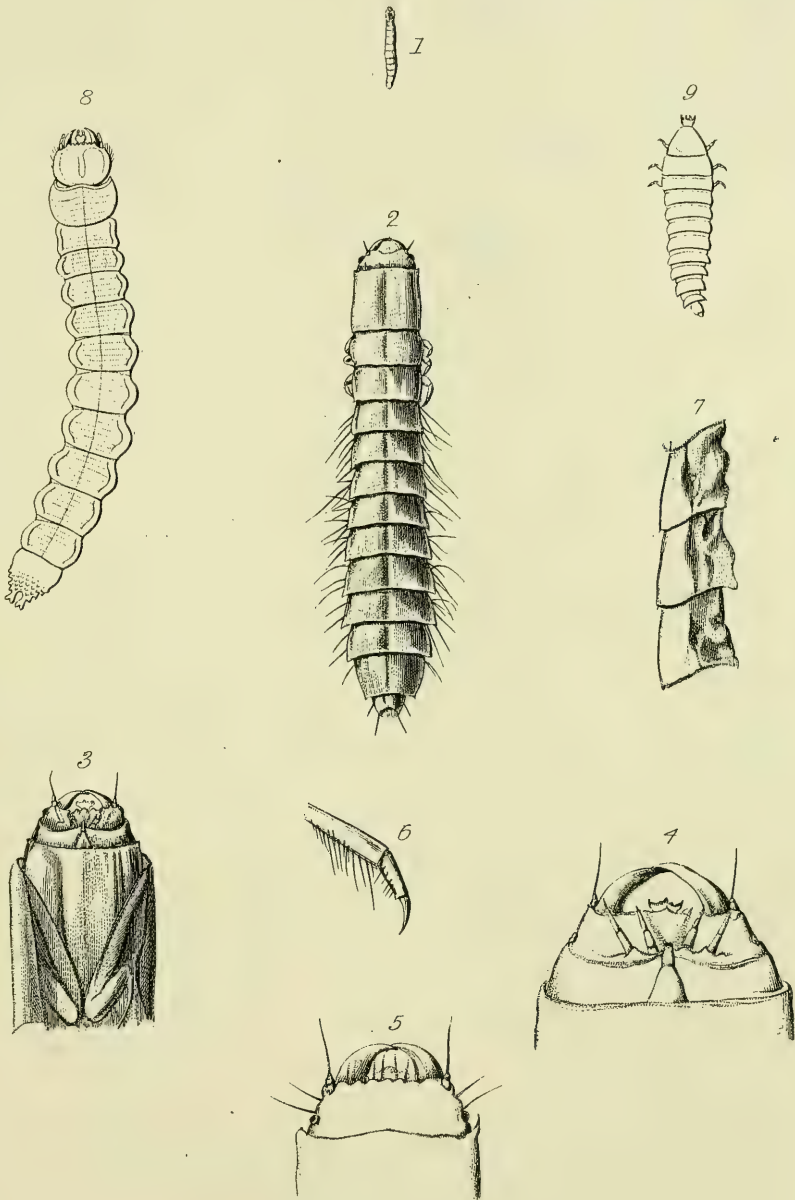
[Read Feb. 7, 1867.]

Ord. CICADINA, *Burmeister*.

Fam. STRIDULANTIA, *Burm*.

Gen. PLATYPLEURA, *Amyot et Serv*.

1. PLATYPLEURA CATOCALOIDES, n. s. Fam. Viridis, testaceo varia; capite linea transversa incisa liturisque duabus lateralibus anticis nigris; prothorace vitta guttisque quatuor nigris; mesothorace vittis



A. Murray del.

G. Jarman sc.

1-7. *Astraptor illuminator*.
8. *Alaus ocellatus*. 9. *Phticturus versicolor*.